REMARKS

As indicated above, this is a Preliminary Amendment for the Request for Continued Examination (RCE) filed herewith.

Claims 1, 4 - 6 and 18 are currently pending in this application. Claims 7 - 17 have been withdrawn from consideration. Claims 2 and 3 have been canceled without prejudice or disclaimer.

Claims 1, 4 and 18 have been amended in order to more particularly point out, and distinctly claim the subject matter to which the applicants regard as their invention.

In the outstanding Action, the following rejections are set forth:

(1) claims 1 - 4, 6 and 18 are rejected under 35 U.S.C. §103(a) as being unpatentable over Takata (U.S. Patent No. 6,500,675) in view of Dubin (U.S. Patent No. 6,359,328); and

(2) claim 5 is rejected under 35 U.S.C. §103(a) as being unpatentable over Takata and Dubin as applied to claim 1 above, and further in view of Brown (U.S. Patent No. 6,306,732).

The applicants respectfully request reconsideration of these rejections.

The applicants' claimed multilayer interconnection structure (as now recited in independent claim 1) or claimed semiconductor device (as now recited in independent claim 18) includes the via-hole, in which the claimed tungsten plug is formed so as to connect the claimed first and second interconnection layers electrically, having a depth/diameter ratio of 1.25 - 3.0. Additional significant claimed structural arrangements of the applicants' claimed invention, as now set forth in each of claims 1 and 18, include the claimed conductive nitride film between an outer wall of the tungsten plug and an inner wall of the via-hole such that the conductive nitride film is defined by an inner wall contacting with the outer wall of the tungsten plug and an outer wall contacting with the inner wall of the via-hole, the conductive nitride film being formed of a first nitride film and a second nitride film stacked inside the first nitride film, the first nitride film having an outer surface and an inner surface, the outer surface of the first nitride film being in intimate contact with the inner wall of the via-hole, the second nitride film having an outer surface and an inner surface, the outer surface of the second nitride film being in intimate contact with the inner surface of the first nitride film, the inner surface of the second nitride film being in intimate contact with the outer surface of the tungsten plug.

It is noted, at the outset, that Dubin teaches an abnormally high value of aspect ratio of 5.5 or more in column 3, line 55 thereof. With Dubin's device, however, the surrounding part of the plug is removed to form gaps 24a and 24b between the plugs 22a and 22b and the interior sidewalls of holes 18a and 18b. (See, column 5, line 44 in Dubin.) Thus, the structure of Dubin lacks the barrier metal

film contrary to the case of the applicants' instant claimed invention or Takata. As such, there is no motivation to a person skilled in the art to use the high aspect ratio of Dubin in Takata, which uses a barrier metal film.

Takata teaches in column 9, line 52 that the barrier metal layer 12a may be a stack of Ti, Ta, W, Mo, or Hf, nitride or silicate thereof.

The Examiner argues on page 3, starting on line 3 that Tanaka discloses "a stacked metal layer/film (see 12a in FIG.6; Col. 9, lines 50-54) formed between an outer wall of the tungsten plug and an inner wall of the via-hole... ." In response, the applicants submit that, according to Tanaka, each nitride film should be accompanied by a metal film part at the bottom part thereof where deposition takes place first in view of the need of avoiding the problem of dust formation explained with reference to Figure 6.

In order to exclude the possibility of a metal film existing between the outer surface of the tungsten plug and the inner surface of the via-hole, the applicants have amended claim 1 in the manner submitted herewith.

Furthermore, the applicants have included the claim amendment of limiting the range of the aspect ratio to 1.25 - 3.0, in view of the description in page 23, line 30 of the originally filed

specification. With such claimed limitations now set forth in the claims, Dubin is positively excluded from the scope of the instant claimed invention.

With regard to the allegation in the outstanding Action that Takata shows the aspect ratio of 2.0 in FIG. 6 thereof, it is submitted that Takata is silent about any specific numerical value for the aspect ratio. There is no guarantee that FIG. 6 of Takata is drawn in the same proportion in the horizontal direction and in the vertical direction.

As to the other secondary reference of Brown, this reference describes a diffusion barrier to improve electromigration reliability. The diffusion barrier is provided in order to prevent the conductive metal (Cu, Al) from diffusing out of a damascene via or interconnect into a surrounding dielectric.

In the applicants' instant claimed invention, a conductive nitride film is provided in order to prevent corrosion of a metal film, such as Ta, in a via hole and corrosion of metal of an interconnection pattern when forming W in the via hole by a CVD process using a highly reactive WF_6 gaseous source.

The process and diffusion barrier of Brown does not describe or suggest a solution for the problem solved by the applicants' claimed invention because highly reactive WF_6 does not appear to be a concern in Brown.

In view of the above, even if, *arguendo*, the teachings of Takata, Dubin and Brown, can be combined in the manner suggested by the Examiner, such combined teachings would still fall far short in fully meeting the applicants' claimed invention, as now set forth in the claims filed herewith. Thus, a person of ordinary skill in the art would not have found the applicants' claimed invention obvious under 35 U.S.C. §103(a) based on Takata in view of Dubin or further in view of Brown.

Accordingly, the withdrawal of the outstanding obviousness rejection under 35 U.S.C. §103(a) based on Takata (U.S. Patent No. 6,500,675) in view of Dubin (U.S. Patent No. 6,359,328), and rejection under 35 U.S.C. §103(a) based on Takata and Dubin, and further in view of Brown (U.S. Patent No. 6,306,732) is in order, and is therefore respectfully solicited.

In view of the aforementioned amendments and accompanying remarks, claims, as amended, are in condition for allowance, which action, at an early date, is requested.

If, for any reason, it is felt that this application is not now in condition for allowance, the Examiner is requested to contact the applicants' undersigned attorney at the telephone number indicated below to arrange for an interview to expedite the disposition of this case.

In the event that this paper is not timely filed, the applicants respectfully petition for an appropriate extension of time. Please charge any fees for such an extension of time and any other fees which may be due with respect to this paper, to Deposit Account No. 01-2340.

Respectfully submitted,

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